

Model construction of a core design concept of the ce20 core for the new research reactor at the “Monju” site

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The new research reactor at the “Monju” site is planned to be constructed in Tsuruga city mainly for neutron beam applications. A tentative core design called ce20 core of the new research reactor has been proposed by Japan Atomic Energy Agency, but the detailed information is not publicly available. In this study, with a neutron transport calculation code based on Monte Carlo method called MVP-3, we performed a model construction corresponding to the ce20 core based on publicly available information for the purpose of advancing our future research activities for the application of the new research reactor. We also evaluated the performance of the core design as a neutron source predicted with our model. Our results showed a clear thermal neutron spectrum with a peak around 45 meV at the reflector region close to the core. Its thermal neutron flux (<0.5 eV) was estimated to be approximately 1.8×10^{14} n/cm²/s when all of the irradiation holders and other equipment around the core are excluded. This means that the ce20 core has an enough performance as a neutron source.

Key Words : New research reactor at the “Monju” site, Neutron transport calculation, Monte Carlo method, MVP-3

1. Introduction

In December 2016, the Japanese government decided to decommission the Japanese prototype sodium-cooled fast breeder reactor “Monju” located in Tsuruga city, Fukui prefecture. Shortly thereafter, it was also decided that the “Monju” site after its decommissioning would be utilized to install a new research reactor. In the current plan, the reactor is a water-cooled reactor with a thermal power of less than 10 MW primarily for neutron beam applications [1]. Furthermore, it is expected to serve as a core hub for R&Ds and educations in the nuclear field in western Japan, as well as to contribute to local economic development. Figure 1 shows a conceptual drawing of the new research reactor. A wide variety of irradiation holes and neutron beamlines is planned to be installed around the central core.

Especially in neutron beam applications, it is fundamental to produce high intensity thermal or cold neutrons.

The design studies for the reactor core or the cold neutron source (CNS) is essential to improve its performance [2]-[4].

A tentative core design concept for the new research reactor called ce20 core is currently proposed by Japan Atomic Energy Agency [5]. However, the details are not publicly available. In this study, we perform a model construction corresponding to the ce20 core based on publicly available information as a starting point for future design studies in the reactor core and the CNS for the new research reactor at “Monju” site. We also present the performance of the core design as a neutron source predicted with our developing model.

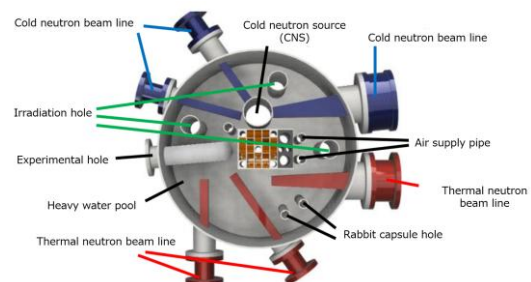


Fig. 1 Conceptual drawing of the new research reactor [6].

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2. Outline of the new research reactor at “Monju” site

2.1 Core

Figure 2 shows an overview of the ce20 core of the new research reactor. The core consists of a fuel region and an irradiation holder installed within a heavy-water pool with a diameter of 2 m. The fuel region is a 40 cm × 40 cm × 75 cm rectangular prism and consists of 16 standard fuel elements, 4 follower fuel elements with control rods, and 5 irradiation holes. The standard fuel elements, follower fuel elements with control rods, and irradiation holes with the dimensions of 7.62 cm × 7.62 cm × 75 cm in common and are arranged in a 5×5 grid. The irradiation holes are loaded at the four outer corners and in the center; the control rod-equipped follower fuel elements are loaded at the four inner corners; and standard fuel elements are loaded in the remaining locations.

The irradiation holder is also installed in the right side of the ce20 core. The irradiation holder consists of two irradiation holes with a diameter of 100 mm and two irradiation holes with a diameter of 50 mm.

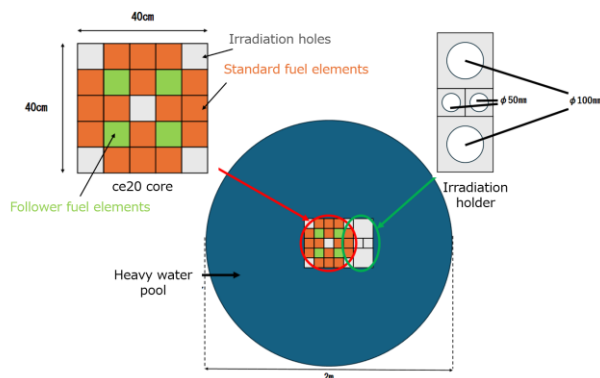


Fig. 2 Horizontal view of the ce20 core of the new research reactor.

2.2 Fuel element

Figure 3 shows an overview of the standard fuel element. The fuel elements consist of fuel plates supported by side plates made of an aluminum alloy, and the dimensions are 7.62 cm × 7.62 cm × 77 cm. Light water, which serves as the coolant, flows between the fuel plates; this light water cools the fuel and moderates the neutrons. Additionally, cadmium wires—which work as burnable poisons—are loaded on the left and right sides of the fuel plates. The fuel type is silicide fuel (U_3Si_2-Al), and the enrichment of uranium-235 is approximately 20wt%. The

uranium density of the aluminide fuel ($UAlx-Al$) previously used in the JRR-3 [7] was approximately 2.2 g/cm³, whereas that of the silicide fuel is 4.8 g/cm³. The higher uranium density increases the amount of uranium per fuel element, making it possible to reduce the number of fuel elements used and increase the irradiation dose. For this reason, the use of silicide fuel is being considered for the new research reactor.

Since the new research reactor employs a follower-type control rod system, there are two types of fuel elements: standard fuel elements and follower fuel elements with control rods. The difference between these two fuel elements lies in whether a control rod is attached to the top of the fuel or not. An overview of the control rods is shown in Figure 4. The control rods are made of hafnium and are hollow rectangular prisms with the dimension of 7.62 cm × 7.62 cm × 70 cm and with a thickness of 5 mm.

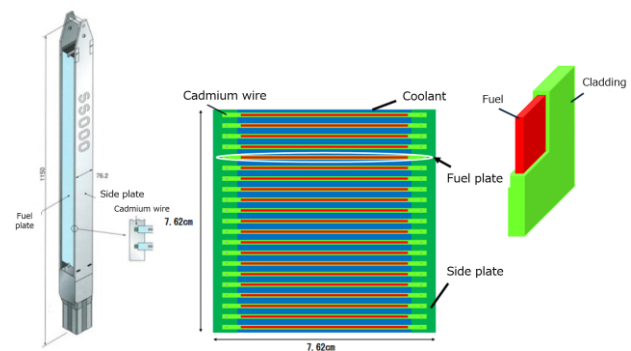


Fig. 3 Overview of the fuel element (left: conceptual drawing of a fuel element [6], center: horizontal view of a fuel element, right bird's eye view of a fuel plate).

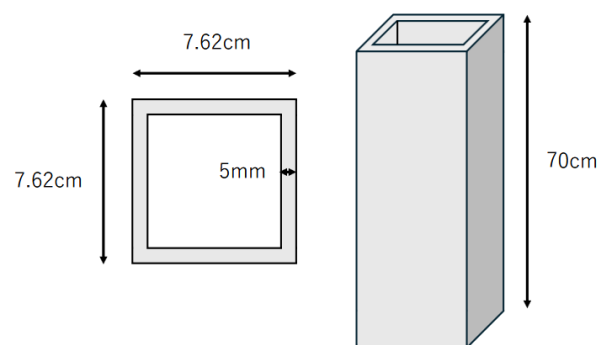


Fig. 4 Overview of the control rod element.

3. Model construction

The 3-dimensional full-core model that we constructed for the ce20 core is based on report of the consortium for

the new research reactor at “Monju” site [8]. Here, our model does not include the irradiation holder or other equipment not only because the specification is subject to a major change but also because the publicly available information on them is not sufficient to construct their models at all. The specification of each component in our model is summarized in Table 1 and Table 2. The detailed information on the geometry of our model is available in Appendix.

Whole core analysis was performed with Monte Carlo neutron transport calculation code MVP-3 [9]–[10]. Here, Japanese Evaluated Nuclear Data Library version 4.0: JENDL-4.0 [11] was used as the cross section data set. The total number of neutron histories for each burn-up step was set to 8,000,000 to ensure that the statistical error with $\pm 3\sigma$ error range of the effective multiplication factor should be 0.1% or less. The total thermal power of the whole core was set to 10 MWt.

We constructed a calculation model based on the above conditions and calculate and the neutron energy spectrum and thermal neutron flux ($< 0.5\text{eV}$) at reflector region for the purpose of studying its performance as a neutron source. The tally region for the neutron flux was set to a cylinder with a radius of 10 cm and a height of 77 cm at distance of 15 cm from the north edge of the core. Although the details have not yet been decided, this is because there is a possibility that a CNS will be installed at this location. The absolute value of the thermal neutron flux ϕ_{th} was calculated with the following equation:

$$\phi_{\text{th}} = \phi_{\text{th_normalized}} \times u_{\text{th}} \times \frac{\nu P}{p_{\text{f}}} \times \frac{1}{k_{\text{eff}}}, \quad (1)$$

where $\phi_{\text{th_normalized}}$ is the normalized thermal neutron flux [lethargy/source], u_{th} is the lethargy width of the thermal group, ν is the number of prompt neutrons per fission reaction unit, P is the total reactor thermal power, p_{f} is thermal power per fission reaction unit, $1/k_{\text{eff}}$ is the reciprocal of effective multiplication factor as a conversion factor into the critical state.

Table 1 Major specification of each component

Components	Item	Value
Fuel plate	Thickness	0.127 cm
	Width	6 cm
	Height	77 cm
Fuel in a fuel plate	Material	$\text{U}_3\text{Si}_2\text{-Al}$
	Thickness	0.05 cm
	Width	0.5 cm
	Height	75 cm
	Weight of uranium	300 g
	Enrichment of uranium-235	20wt%
	Density	4.8 g/cm^3
	Temperature	100 °C
Cladding in a fuel plate	Material	Aluminum alloy
	Thickness	0.038 cm
	Height	77 cm
	Temperature	80 °C
Cadmium wire	Diameter	0.02 cm
	Length	75 cm
	Temperature	80 °C
Coolant	Material	Light water
	Temperature	45 °C
Heavy water pool	Diameter	200 cm
	Height	300 cm
	Temperature	20 °C
Control rod	Material	Hafnium
	Thickness	0.5 cm
	Width	7.62 cm
	Height	70 cm
	Temperature	45 °C

Table 2 Material composition of each component

Components	Nuclide	Value [atoms/b/cm]
Fuel in a fuel plate	U-235	2.4596E-03
	U-238	9.7141E-03
	Si-28	7.4820E-03
	Si-29	3.7698E-04
	Si-30	2.4648E-04
	Al-27	2.4654E-02
Cladding in a fuel plate	Al-27	6.0261E-02
Cadmium wire	Cd-106	5.7691E-04
	Cd-108	4.1148E-04
	Cd-110	5.7783E-03
	Cd-111	5.9289E-03
	Cd-112	1.1172E-02
	Cd-113	5.6657E-03
	Cd-114	1.3324E-02
	Cd-116	3.4809E-03
Coolant	H-1	6.6473E-02
	O-16	3.3236E-02
Heavy water pool	H-2	6.6466E-02
	O-16	3.3233E-02
Control rod	Hf-174	7.2300E-05
	Hf-176	2.3531E-03
	Hf-177	8.3437E-03
	Hf-178	1.2251E-02
	Hf-179	6.1208E-03
	Hf-180	1.5771E-02

4. Calculation result

Figure 5 shows CGVIEW ^[10] output for our model. It can be seen that the geometries of the core are correctly described in our model. Figure 6 shows the neutron energy spectrum at the heavy water reflector region. We can see a clear thermal neutron spectrum with a peak around 45 meV. In other words, the neutrons are sufficiently moderated. Furthermore, the thermal neutron flux of the tally region as shown in the light blue circle on the left drawing in Fig. 5 is calculated to be approximately 1.8×10^{14} n/cm²/s, and it shows sufficient performance as a reactor for neutron beam applications. However, it should be noted that the thermal neutron flux is expected to be lower than this flux in its finalized design because the

irradiation holder and various other equipment working as neutron absorbers will be installed around the core.

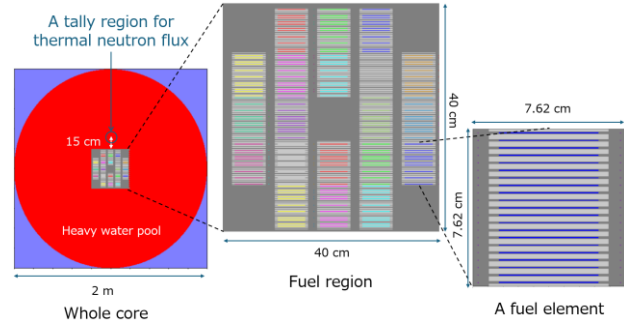


Fig. 5 Geometry of our model.

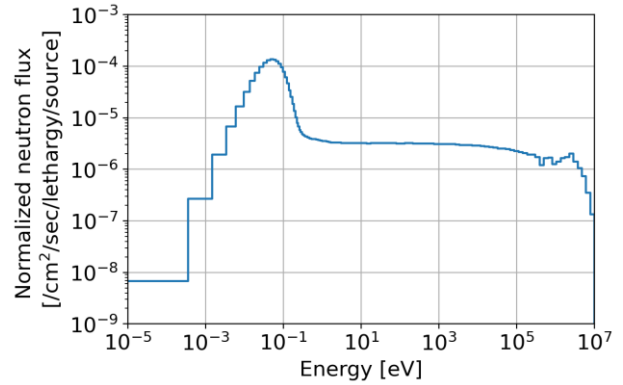


Fig. 6 Normalized neutron flux at heavy water reflector region.

5. Conclusion

In this study, we performed a model construction corresponding to the ce20 core of the new research reactor at “Monju” site based on publicly available information. We also evaluated the performance of the core design as a neutron source predicted with our developing model. Our results showed that a clear thermal neutron spectrum with a peak around 45 meV at the reflector region, and its thermal neutron flux was estimated to be approximately 1.8×10^{14} n/cm²/s. This means that the ce20 core has an enough performance as a neutron source.

As a next step, we plan to use this model to advance design study on the CNS and to develop methods for producing radioisotopes through irradiation using this core. In particular, with regard to design study on the CNS, we aim to perform more reliable analysis by incorporating newly evaluated thermal neutron scattering cross section data developed by our group and our collaborators ^{[12]-[15]}.

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Appendix

From the viewpoint of the collaborative research activities in near future, it is convenient to make the detailed information on our model publicly available especially when we intend to share the information with some non-residents under the Foreign Exchange and Foreign Trade Act in Japan, namely international students staying in Japan for six months or less and visiting researchers from overseas on our campus. Therefore, as an example, a sample input data of MVP-3 in our model is shown below:

```

Sample input for cc20 core of new research reactor

21 fuel plate + 42 Cd-wires(0.40mm) as burnable poison for each fuel element
*

*-----+-----+----- MVP-BURN INPUT START +-----+-----+--

*$$$MVPBURN

*$BURNUP

* TITLE1('New Research Reactor')

* TITLE2('Burnup Cal.')

* CASEID( JNRR ) /* 4-characters without blank

** NSTEP(14) /* determined by number of input data for MWDT

* DAYINT(0.5 7 30 60 100 150 200 250 300 350 400 450 500 600)

** K-eff cal.(MVP) is not done in the last step (only for densities)

* PC( 14(1) ) /* PC-Method

*****

** 0.5 1.0 2.0 5.0 10.0 15.0 20.0

** 25.0 30.0 40.0 50.0 60.0 70.0 80.0

** 90.0 97.0 ) /* Burn-up ( U235 %) for 16-step model

** PC( 8(1) 8(0) ) /* PC-method for 16-step model

*****

* POWERL( <%NSTEP>(10) ) /* Power level in MW (MW/cm,if 2D)

** CPUTIME( 100.0 ) /* CPU time limit (min.)

** if CPUTIME is not specified, time-stop is not effective

* START(1) /* Start step # (0:restart/1...NSTEP)

* SAVE-MVP-OUTPUT ( <%NSTEP>(1011) )

** N = N1*1000 + N2*100 + N3*100 + N4

** N1 = 1 : keep standard input file for MVP (caseVI##)

** N2 = 1 : keep binary fission site file of MVP (caseVS##)

** N3 = 1 : keep binary output file of MVP (caseVR##)

** N4 = 1 : keep standard output of MVP for all steps(##) (caseVP##)

**

***** other options (if necessary) *****

** SUBSTEPS( <%NSTEP>(20) ) /* number of sub-steps in each step

** STOP( <%NSTEP> ) /* Last step # (1...NSTEP:default) for testing

** PRINT( 0 ) /* Print level (0...3)

** DENINIT(1.0E-20) /* Not-defined initial number densities of dep.nuc.

** PDSCHK(1) /* Printing level of PDS access information

** IBMOD( 0 ) /* Change burnup input data in Restart case (0/1=no/yes)

```

** ACCEPT-ZERO-RATE /* Accept zero or small reaction rate (<1.0e-35)

** and

*SEND BURNUP

**

*\$SEND MVPBURN

*

* option

*

NO-RESTART

LATTICE RUSS-ROUL

FISSION EIGEN-VALUE FLUX-PRINT TALLY-LATTICE

NO-EDIT-MACROSCOPIC-DATA(03333030)

EDIT-MICROSCOPIC-DATA(00303030)

DYNAMIC-MEMORY(100000000000)

* Control data for MVP calculation

% NHIST = 10000 /* no. of neutrons in a batch

% KBATCH = 800 /* no. of batches for tallies

% NSKIP = 100 /* no. of batches before tallies

% TCPU = 0 /* CPU time limit (min.), =0: no limit

% IRAND = 11111111 /* initial random number

% NBATCH = KBATCH + NSKIP /* total no. of batches

% NG = 2 /* no. of energy groups for tallies

*

NGROUP(<NG>) NMEMO(45)

TCPU(<TCPU>)

*

NPART(<NBATCH*NHIST>) NHIST(<NHIST>) NSKIP(<NSKIP>)

NBANK(<INT(1.250*NHIST)>) NFBANK(<NHIST>)

IRAND(<IRAND>)

*

ETOP(1.0E+7) EBOT(1.0E-5)

EW CUT(0.1)

*

* Cross section or Material composition data

% FUEL1 = 1 , FUEL2 = 2 , FUEL3 = 3 , FUEL4 = 4

% FUEL5 = 5 , FUEL6 = 6 , FUEL7 = 7 , FUEL8 = 8

% FUEL9 = 9 , FUEL10 = 10 , FUEL11 = 11 , FUEL12 = 12

% FUEL13 = 13 , FUEL14 = 14 , FUEL15 = 15 , FUEL16 = 16

% FUEL17 = 17 , FUEL18 = 18 , FUEL19 = 19 , FUEL20 = 20

% MCLAD = 21

% MCAD1 = 22 , MCAD2 = 23 , MCAD3 = 24 , MCAD4 = 25

% MCAD5 = 26 , MCAD6 = 27 , MCAD7 = 28 , MCAD8 = 29

% MCAD9 = 30 , MCA10 = 31 , MCA11 = 32 , MCA12 = 33

% MCA13 = 34 , MCA14 = 35 , MCA15 = 36 , MCA16 = 37

% MCA17 = 38 , MCA18 = 39 , MCA19 = 40 , MCA20 = 41

% MH2O = 42 , MD2O = 43 , HAFNI = 44

%% FTEMP = 380 , CTEMP = 334.0

% FTEMP = 373.15 , CLDTEMP = 353.15 , CTEMP = 318.15 , RTEMP = 293.15

% PI = 3.1415926536

% RCDWR = 0.02

% HT = 77

% VOLCDWR = PI*RCDWR*RCDWR*HT*2*21

SXSEC

*

* FUEL

& IDMAT(<FUEL1>)

*MVPBURN VOLM(393.75) TRGNAM(@FUE1) TEMP(<FTEMP>)

TEMPMT(<FTEMP>) /* temperature for no-burnup problem

U02350J40(2.4595E-3)

U02380J40(9.7140E-3)

SI0280J40(7.4820E-3)

SI0290J40(3.7697E-4)

SI0300J40(2.4647E-4)

AL0270J40(2.4653E-2)

*

& IDMAT(<FUEL2>)

*MVPBURN VOLM(393.75) TRGNAM(@FUE2) TEMP(<FTEMP>)

TEMPMT(<FTEMP>) /* temperature for no-burnup problem

U02350J40(2.4595E-3)

U02380J40(9.7140E-3)

SI0280J40(7.4820E-3)

SI0290J40(3.7697E-4)

SI0300J40(2.4647E-4)

AL0270J40(2.4653E-2)

*

& IDMAT(<FUEL3>)

*MVPBURN VOLM(393.75) TRGNAM(@FUE3) TEMP(<FTEMP>)

TEMPMT(<FTEMP>) /* temperature for no-burnup problem

U02350J40(2.4595E-3)

U02380J40(9.7140E-3)

SI0280J40(7.4820E-3)

SI0290J40(3.7697E-4)

SI0300J40(2.4647E-4)

AL0270J40(2.4653E-2)

*

& IDMAT(<FUEL4>)

*MVPBURN VOLM(393.75) TRGNAM(@FUE4) TEMP(<FTEMP>)

TEMPMT(<FTEMP>) /* temperature for no-burnup problem

U02350J40(2.4595E-3)

U02380J40(9.7140E-3)

SI0280J40(7.4820E-3)

SI0290J40(3.7697E-4)

SI0300J40(2.4647E-4)

AL0270J40(2.4653E-2)

*

& IDMAT(<FUEL5>)

*MVPBURN VOLM(393.75) TRGNAM(@FUE5) TEMP(<FTEMP>)

TEMPMT(<FTEMP>) /* temperature for no-burnup problem

U02350J40(2.4595E-3)

U02380J40(9.7140E-3)

SI0280J40(7.4820E-3)

SI0290J40(3.7697E-4)

SI0300J40(2.4647E-4)

AL0270J40(2.4653E-2)

*

& IDMAT(<FUEL6>)

*MVPBURN VOLM(393.75) TRGNAM(@FUE6) TEMP(<FTEMP>)

TEMPMT(<FTEMP>) /* temperature for no-burnup problem

U02350J40(2.4595E-3)

U02380J40(9.7140E-3)

SI0280J40(7.4820E-3)

SI0290J40(3.7697E-4)

SI0300J40(2.4647E-4)

AL0270J40(2.4653E-2)

*

& IDMAT(<FUEL7>)

*MVPBURN VOLM(393.75) TRGNAM(@FUE7) TEMP(<FTEMP>)

TEMPMT(<FTEMP>) /* temperature for no-burnup problem

U02350J40(2.4595E-3)

U02380J40(9.7140E-3)

SI0280J40(7.4820E-3)

SI0290J40(3.7697E-4)

SI0300J40(2.4647E-4)

AL0270J40(2.4653E-2)

*

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*MVPBURN VOLM(393.75) TRGNAM(@FUE8) TEMP(<FTEMP>)

TEMPMT(<FTEMP>) /* temperature for no-burnup problem

U02350J40(2.4595E-3)

U02380J40(9.7140E-3)

SI0280J40(7.4820E-3)

SI0290J40(3.7697E-4)

SI0300J40(2.4647E-4)

AL0270J40(2.4653E-2)

*

& IDMAT(<FUEL9>)

*MVPBURN VOLM(393.75) TRGNAM(@FUE9) TEMP(<FTEMP>)

TEMPMT(<FTEMP>) /* temperature for no-burnup problem

U02350J40(2.4595E-3)

U02380J40(9.7140E-3)

SI0280J40(7.4820E-3)

SI0290J40(3.7697E-4)

SI0300J40(2.4647E-4)

AL0270J40(2.4653E-2)

*

& IDMAT(<FUE10>)

*MVPBURN VOLM(393.75) TRGNAM(@FU10) TEMP(<FTEMP>)

TEMPMT(<FTEMP>) /* temperature for no-burnup problem

U02350J40(2.4595E-3)

U02380J40(9.7140E-3)

SI0280J40(7.4820E-3)

SI0290J40(3.7697E-4)

SI0300J40(2.4647E-4)

AL0270J40(2.4653E-2)

*

& IDMAT(<FUE11>)

*MVPBURN VOLM(393.75) TRGNAM(@FU11) TEMP(<FTEMP>)

TEMPMT(<FTEMP>) /* temperature for no-burnup problem

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U02380J40(9.7140E-3)

SI0280J40(7.4820E-3)

SI0290J40(3.7697E-4)

SI0300J40(2.4647E-4)

AL0270J40(2.4653E-2)

*

& IDMAT(<FUE12>)

*MVPBURN VOLM(393.75) TRGNAM(@FU12) TEMP(<FTEMP>)

TEMPMT(<FTEMP>) /* temperature for no-burnup problem

U02350J40(2.4595E-3)

U02380J40(9.7140E-3)

SI0280J40(7.4820E-3)

SI0290J40(3.7697E-4)

SI0300J40(2.4647E-4)

AL0270J40(2.4653E-2)

*

& IDMAT(<FUE13>)

*MVPBURN VOLM(393.75) TRGNAM(@FU13) TEMP(<FTEMP>)

TEMPMT(<FTEMP>) /* temperature for no-burnup problem

U02350J40(2.4595E-3)

U02380J40(9.7140E-3)

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SI0300J40(2.4647E-4)

AL0270J40(2.4653E-2)

*

& IDMAT(<FUE14>)

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TEMPMT(<FTEMP>) /* temperature for no-burnup problem

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U02380J40(9.7140E-3)

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SI0290J40(3.7697E-4)

SI0300J40(2.4647E-4)

AL0270J40(2.4653E-2)

*

& IDMAT(<FUE15>)

*MVPBURN VOLM(393.75) TRGNAM(@FU15) TEMP(<FTEMP>)

```

TEMPMT( <FTEMP> )      /* temperature for no-burnup problem

U02350J40( 2.4595E-3 )

U02380J40( 9.7140E-3 )

SI0280J40( 7.4820E-3 )

SI0290J40( 3.7697E-4 )

SI0300J40( 2.4647E-4 )

AL0270J40( 2.4653E-2 )

*

& IDMAT( <FUE16> )

*MVPBURN  VOLM(393.75)  TRGNAM(@FU16)  TEMP(<FTEMP>)

TEMPMT( <FTEMP> )      /* temperature for no-burnup problem

U02350J40( 2.4595E-3 )

U02380J40( 9.7140E-3 )

SI0280J40( 7.4820E-3 )

SI0290J40( 3.7697E-4 )

SI0300J40( 2.4647E-4 )

AL0270J40( 2.4653E-2 )

*

& IDMAT( <FUE17> )

*MVPBURN  VOLM(393.75)  TRGNAM(@FU17)  TEMP(<FTEMP>)

TEMPMT( <FTEMP> )      /* temperature for no-burnup problem

U02350J40( 2.4595E-3 )

U02380J40( 9.7140E-3 )

SI0280J40( 7.4820E-3 )

SI0290J40( 3.7697E-4 )

SI0300J40( 2.4647E-4 )

AL0270J40( 2.4653E-2 )

*

& IDMAT( <FUE18> )

*MVPBURN  VOLM(393.75)  TRGNAM(@FU18)  TEMP(<FTEMP>)

TEMPMT( <FTEMP> )      /* temperature for no-burnup problem

U02350J40( 2.4595E-3 )

U02380J40( 9.7140E-3 )

SI0280J40( 7.4820E-3 )

SI0290J40( 3.7697E-4 )

SI0300J40( 2.4647E-4 )

AL0270J40( 2.4653E-2 )

*

& IDMAT( <FUE19> )

*MVPBURN  VOLM(393.75)  TRGNAM(@FU19)  TEMP(<FTEMP>)

TEMPMT( <FTEMP> )      /* temperature for no-burnup problem

U02350J40( 2.4595E-3 )

U02380J40( 9.7140E-3 )

SI0280J40( 7.4820E-3 )

SI0290J40( 3.7697E-4 )

SI0300J40( 2.4647E-4 )

AL0270J40( 2.4653E-2 )

*

& IDMAT( <FUE20> )

*MVPBURN  VOLM(393.75)  TRGNAM(@FU20)  TEMP(<FTEMP>)

TEMPMT( <FTEMP> )      /* temperature for no-burnup problem

```

```

U02350J40( 2.4595E-3 )

U02380J40( 9.7140E-3 )

SI0280J40( 7.4820E-3 )

SI0290J40( 3.7697E-4 )

SI0300J40( 2.4647E-4 )

AL0270J40( 2.4653E-2 )

*

* ALUMINIUM CLADDING

& IDMAT( <MCLAD> )      /* temperature for no-burnup problem

TEMPMT( <CLDTEMP>)

AL0270J40( 6.02612E-2 )

*

* Cd WIRE

& IDMAT( <MCAD1> )

*MVPBURN  VOLM(<VOLCDWR>)  TRGNAM(@CDW1)  TEMP(<CLDTEMP>)

TEMPMT( <CLDTEMP>)      /* temperature for no-burnup problem

CD1060J40( 5.76907E-4 )

CD1080J40( 4.11480E-4 )

CD1100J40( 5.77833E-3 )

CD1110J40( 5.92893E-3 )

CD1120J40( 1.11716E-2 )

CD1130J40( 5.66573E-3 )

CD1140J40( 1.33240E-2 )

CD1160J40( 3.48090E-3 )

*

& IDMAT( <MCAD2> )

*MVPBURN  VOLM(<VOLCDWR>)  TRGNAM(@CDW2)  TEMP(<CLDTEMP>)

TEMPMT( <CLDTEMP>)      /* temperature for no-burnup problem

CD1060J40( 5.76907E-4 )

CD1080J40( 4.11480E-4 )

CD1100J40( 5.77833E-3 )

CD1110J40( 5.92893E-3 )

CD1120J40( 1.11716E-2 )

CD1130J40( 5.66573E-3 )

CD1140J40( 1.33240E-2 )

CD1160J40( 3.48090E-3 )

*

& IDMAT( <MCAD3> )

*MVPBURN  VOLM(<VOLCDWR>)  TRGNAM(@CDW3)  TEMP(<CLDTEMP>)

TEMPMT( <CLDTEMP>)      /* temperature for no-burnup problem

CD1060J40( 5.76907E-4 )

CD1080J40( 4.11480E-4 )

CD1100J40( 5.77833E-3 )

CD1110J40( 5.92893E-3 )

CD1120J40( 1.11716E-2 )

CD1130J40( 5.66573E-3 )

CD1140J40( 1.33240E-2 )

CD1160J40( 3.48090E-3 )

*

& IDMAT( <MCAD4> )

*MVPBURN  VOLM(<VOLCDWR>)  TRGNAM(@CDW4)  TEMP(<CLDTEMP>)

```

TEMPMT(<CLDTEMP>) /* temperature for no-burnup problem	CD1100J40(5.77833E-3)
CD1060J40(5.76907E-4)	CD1110J40(5.92893E-3)
CD1080J40(4.11480E-4)	CD1120J40(1.11716E-2)
CD1100J40(5.77833E-3)	CD1130J40(5.66573E-3)
CD1110J40(5.92893E-3)	CD1140J40(1.33240E-2)
CD1120J40(1.11716E-2)	CD1160J40(3.48090E-3)
CD1130J40(5.66573E-3)	*
CD1140J40(1.33240E-2)	& IDMAT(<MCAD9>)
CD1160J40(3.48090E-3)	*MVPBURN VOLM(<VOLCDWR>) TRGNAM(@CDW9) TEMP(<CLDTEMP>)
*	TEMPMT(<CLDTEMP>) /* temperature for no-burnup problem
& IDMAT(<MCAD5>)	CD1060J40(5.76907E-4)
*MVPBURN VOLM(<VOLCDWR>) TRGNAM(@CDW5) TEMP(<CLDTEMP>)	CD1080J40(4.11480E-4)
TEMPMT(<CLDTEMP>) /* temperature for no-burnup problem	CD1100J40(5.77833E-3)
CD1060J40(5.76907E-4)	CD1110J40(5.92893E-3)
CD1080J40(4.11480E-4)	CD1120J40(1.11716E-2)
CD1100J40(5.77833E-3)	CD1130J40(5.66573E-3)
CD1110J40(5.92893E-3)	CD1140J40(1.33240E-2)
CD1120J40(1.11716E-2)	CD1160J40(3.48090E-3)
CD1130J40(5.66573E-3)	*
CD1140J40(1.33240E-2)	& IDMAT(<MCA10>)
CD1160J40(3.48090E-3)	*MVPBURN VOLM(<VOLCDWR>) TRGNAM(@CD10) TEMP(<CLDTEMP>)
*	TEMPMT(<CLDTEMP>) /* temperature for no-burnup problem
& IDMAT(<MCAD6>)	CD1060J40(5.76907E-4)
*MVPBURN VOLM(<VOLCDWR>) TRGNAM(@CDW6) TEMP(<CLDTEMP>)	CD1080J40(4.11480E-4)
TEMPMT(<CLDTEMP>) /* temperature for no-burnup problem	CD1100J40(5.77833E-3)
CD1060J40(5.76907E-4)	CD1110J40(5.92893E-3)
CD1080J40(4.11480E-4)	CD1120J40(1.11716E-2)
CD1100J40(5.77833E-3)	CD1130J40(5.66573E-3)
CD1110J40(5.92893E-3)	CD1140J40(1.33240E-2)
CD1120J40(1.11716E-2)	CD1160J40(3.48090E-3)
CD1130J40(5.66573E-3)	*
CD1140J40(1.33240E-2)	& IDMAT(<MCA11>)
CD1160J40(3.48090E-3)	*MVPBURN VOLM(<VOLCDWR>) TRGNAM(@CD11) TEMP(<CLDTEMP>)
*	TEMPMT(<CLDTEMP>) /* temperature for no-burnup problem
& IDMAT(<MCAD7>)	CD1060J40(5.76907E-4)
*MVPBURN VOLM(<VOLCDWR>) TRGNAM(@CDW7) TEMP(<CLDTEMP>)	CD1080J40(4.11480E-4)
TEMPMT(<CLDTEMP>) /* temperature for no-burnup problem	CD1100J40(5.77833E-3)
CD1060J40(5.76907E-4)	CD1110J40(5.92893E-3)
CD1080J40(4.11480E-4)	CD1120J40(1.11716E-2)
CD1100J40(5.77833E-3)	CD1130J40(5.66573E-3)
CD1110J40(5.92893E-3)	CD1140J40(1.33240E-2)
CD1120J40(1.11716E-2)	CD1160J40(3.48090E-3)
CD1130J40(5.66573E-3)	*
CD1140J40(1.33240E-2)	& IDMAT(<MCA12>)
CD1160J40(3.48090E-3)	*MVPBURN VOLM(<VOLCDWR>) TRGNAM(@CD12) TEMP(<CLDTEMP>)
*	TEMPMT(<CLDTEMP>) /* temperature for no-burnup problem
& IDMAT(<MCAD8>)	CD1060J40(5.76907E-4)
*MVPBURN VOLM(<VOLCDWR>) TRGNAM(@CDW8) TEMP(<CLDTEMP>)	CD1080J40(4.11480E-4)
TEMPMT(<CLDTEMP>) /* temperature for no-burnup problem	CD1100J40(5.77833E-3)
CD1060J40(5.76907E-4)	CD1110J40(5.92893E-3)
CD1080J40(4.11480E-4)	CD1120J40(1.11716E-2)

```

CD1130J40( 5.66573E-3 )

CD1140J40( 1.33240E-2 )

CD1160J40( 3.48090E-3 )

*

& IDMAT( <MCA13> )

*MVPBURN VOLM(<VOLCDWR>) TRGNAM(@CD13) TEMP(<CLDTEMP>)

TEMPMT( <CLDTEMP>) /* temperature for no-burnup problem

CD1060J40( 5.76907E-4 )

CD1080J40( 4.11480E-4 )

CD1100J40( 5.77833E-3 )

CD1110J40( 5.92893E-3 )

CD1120J40( 1.11716E-2 )

CD1130J40( 5.66573E-3 )

CD1140J40( 1.33240E-2 )

CD1160J40( 3.48090E-3 )

*

& IDMAT( <MCA14> )

*MVPBURN VOLM(<VOLCDWR>) TRGNAM(@CD14) TEMP(<CLDTEMP>)

TEMPMT( <CLDTEMP>) /* temperature for no-burnup problem

CD1060J40( 5.76907E-4 )

CD1080J40( 4.11480E-4 )

CD1100J40( 5.77833E-3 )

CD1110J40( 5.92893E-3 )

CD1120J40( 1.11716E-2 )

CD1130J40( 5.66573E-3 )

CD1140J40( 1.33240E-2 )

CD1160J40( 3.48090E-3 )

*

& IDMAT( <MCA15> )

*MVPBURN VOLM(<VOLCDWR>) TRGNAM(@CD15) TEMP(<CLDTEMP>)

TEMPMT( <CLDTEMP>) /* temperature for no-burnup problem

CD1060J40( 5.76907E-4 )

CD1080J40( 4.11480E-4 )

CD1100J40( 5.77833E-3 )

CD1110J40( 5.92893E-3 )

CD1120J40( 1.11716E-2 )

CD1130J40( 5.66573E-3 )

CD1140J40( 1.33240E-2 )

CD1160J40( 3.48090E-3 )

*

& IDMAT( <MCA16> )

*MVPBURN VOLM(<VOLCDWR>) TRGNAM(@CD16) TEMP(<CLDTEMP>)

TEMPMT( <CLDTEMP>) /* temperature for no-burnup problem

CD1060J40( 5.76907E-4 )

CD1080J40( 4.11480E-4 )

CD1100J40( 5.77833E-3 )

CD1110J40( 5.92893E-3 )

CD1120J40( 1.11716E-2 )

CD1130J40( 5.66573E-3 )

CD1140J40( 1.33240E-2 )

CD1160J40( 3.48090E-3 )

```

```

*

& IDMAT( <MCA17> )

*MVPBURN VOLM(<VOLCDWR>) TRGNAM(@CD17) TEMP(<CLDTEMP>)

TEMPMT( <CLDTEMP>) /* temperature for no-burnup problem

CD1060J40( 5.76907E-4 )

CD1080J40( 4.11480E-4 )

CD1100J40( 5.77833E-3 )

CD1110J40( 5.92893E-3 )

CD1120J40( 1.11716E-2 )

CD1130J40( 5.66573E-3 )

CD1140J40( 1.33240E-2 )

CD1160J40( 3.48090E-3 )

*

& IDMAT( <MCA18> )

*MVPBURN VOLM(<VOLCDWR>) TRGNAM(@CD18) TEMP(<CLDTEMP>)

TEMPMT( <CLDTEMP>) /* temperature for no-burnup problem

CD1060J40( 5.76907E-4 )

CD1080J40( 4.11480E-4 )

CD1100J40( 5.77833E-3 )

CD1110J40( 5.92893E-3 )

CD1120J40( 1.11716E-2 )

CD1130J40( 5.66573E-3 )

CD1140J40( 1.33240E-2 )

CD1160J40( 3.48090E-3 )

*

& IDMAT( <MCA19> )

*MVPBURN VOLM(<VOLCDWR>) TRGNAM(@CD19) TEMP(<CLDTEMP>)

TEMPMT( <CLDTEMP>) /* temperature for no-burnup problem

CD1060J40( 5.76907E-4 )

CD1080J40( 4.11480E-4 )

CD1100J40( 5.77833E-3 )

CD1110J40( 5.92893E-3 )

CD1120J40( 1.11716E-2 )

CD1130J40( 5.66573E-3 )

CD1140J40( 1.33240E-2 )

CD1160J40( 3.48090E-3 )

*

& IDMAT( <MCA20> )

*MVPBURN VOLM(<VOLCDWR>) TRGNAM(@CD20) TEMP(<CLDTEMP>)

TEMPMT( <CLDTEMP>) /* temperature for no-burnup problem

CD1060J40( 5.76907E-4 )

CD1080J40( 4.11480E-4 )

CD1100J40( 5.77833E-3 )

CD1110J40( 5.92893E-3 )

CD1120J40( 1.11716E-2 )

CD1130J40( 5.66573E-3 )

CD1140J40( 1.33240E-2 )

CD1160J40( 3.48090E-3 )

*

* COOLANT

& IDMAT( <MH2O> )

```

```
TEMPMT( <CTEMP> )

H0001HJ40( 6.6472E-2 )

O00160J40( 3.3236E-2 )

*

& IDMAT( <MD2O> )

TEMPMT( <RTEMP> )

H0002DJ40( 6.6466E-2 )

O00160J40( 3.3233E-2 )

*

& IDMAT( <HAFNI> )

TEMPMT( <RTEMP> )

HF1740J40( 7.2300E-5 )

HF1760J40( 2.3531E-3 )

HF1770J40( 8.3437E-3 )

HF1780J40( 1.2250E-2 )

HF1790J40( 6.1208E-3 )

HF1800J40( 1.5771E-2 )

*

*

$END XSEC

*****GEOMETRY DATA *****

$GEOMETRY

% XCM = 7.62 , DO = 7.62/21 , DI = 7.62/42

***** LATTICE DATA *****

***** Core ID=100 *****

IDLAT( 100 )

LTYPI( 1 ) NVLAT( 5 5 1 ) SZLAT( 7.62 7.62 <HT> )

KLATT( 1 2 3 4 1

5 6 7 8 9

10 11 1 12 13

14 15 16 17 18

1 19 20 21 1 )

KSLAT( < 5*5 >(0) )

END

***** BODY DATA *****

RPP( 10 -20 20 -20 20 0 80 )

RPP( 20 -19.05 19.05 -19.05 19.05 0 <HT> )

CYL( 30 0 0 -30 330 100 )

RPP( 40 19.05 34.49 -19.05 19.05 0 <HT> )

CYL( 50 0 35 0 <HT> 10 )

RPP( 60 -20 20 -20 20 -30 0 )

***** IRRADIATION HOLE *****

CYL( 100 0 0 0 100 10 )

CYL( 200 3.81 3.81 0 <HT> 2.5 )

RPP( 300 0 7.62 0 7.62 0 <HT> )

RPP( 400 0 15.24 0 15.24 0 100 )

***** Control rod *****

RPP( 510 -11.43 -3.81 -11.43 -3.81 <HT> <HT+70> )

RPP( 511 -10.93 -4.31 -10.93 -4.31 <HT> <HT+70> )
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RPP( 520 -11.43 -3.81 3.81 11.43 <HT> <HT+70> )

RPP( 521 -10.93 -4.31 4.31 10.93 <HT> <HT+70> )

RPP( 530 3.81 11.43 -11.43 -3.81 <HT> <HT+70> )

RPP( 531 4.31 10.93 -10.93 -4.31 <HT> <HT+70> )

RPP( 540 3.81 11.43 3.81 11.43 <HT> <HT+70> )

RPP( 541 4.31 10.93 4.31 10.93 <HT> <HT+70> )

***** WATER *****

RPP( 1001 0.81 6.81 0 <DI-0.063> 0 <HT> )

RPP( 1002 0.81 6.81 <DI+0.063> <DO+DI-0.063> 0 <HT> )

RPP( 1003 0.81 6.81 <2*DO+DI+0.063> <3*DO+DI-0.063> 0 <HT> )

RPP( 1004 0.81 6.81 <3*DO+DI+0.063> <4*DO+DI-0.063> 0 <HT> )

RPP( 1005 0.81 6.81 <4*DO+DI+0.063> <5*DO+DI-0.063> 0 <HT> )

RPP( 1006 0.81 6.81 <5*DO+DI+0.063> <6*DO+DI-0.063> 0 <HT> )

RPP( 1007 0.81 6.81 <6*DO+DI+0.063> <7*DO+DI-0.063> 0 <HT> )

RPP( 1008 0.81 6.81 <7*DO+DI+0.063> <8*DO+DI-0.063> 0 <HT> )

RPP( 1009 0.81 6.81 <8*DO+DI+0.063> <9*DO+DI-0.063> 0 <HT> )

RPP( 1010 0.81 6.81 <9*DO+DI+0.063> <10*DO+DI-0.063> 0 <HT> )

RPP( 1011 0.81 6.81 <10*DO+DI+0.063> <11*DO+DI-0.063> 0 <HT> )

RPP( 1012 0.81 6.81 <11*DO+DI+0.063> <12*DO+DI-0.063> 0 <HT> )

RPP( 1013 0.81 6.81 <12*DO+DI+0.063> <13*DO+DI-0.063> 0 <HT> )

RPP( 1014 0.81 6.81 <13*DO+DI+0.063> <14*DO+DI-0.063> 0 <HT> )

RPP( 1015 0.81 6.81 <14*DO+DI+0.063> <15*DO+DI-0.063> 0 <HT> )

RPP( 1016 0.81 6.81 <15*DO+DI+0.063> <16*DO+DI-0.063> 0 <HT> )

RPP( 1017 0.81 6.81 <16*DO+DI+0.063> <17*DO+DI-0.063> 0 <HT> )

RPP( 1018 0.81 6.81 <17*DO+DI+0.063> <18*DO+DI-0.063> 0 <HT> )

RPP( 1019 0.81 6.81 <18*DO+DI+0.063> <19*DO+DI-0.063> 0 <HT> )

RPP( 1020 0.81 6.81 <19*DO+DI+0.063> <20*DO+DI-0.063> 0 <HT> )

RPP( 1021 0.81 6.81 <20*DO+DI+0.063> <XCM> 0 <HT> )

RPP( 1022 0.81 6.81 <DO+DI+0.063> <2*DO+DI-0.063> 0 <HT> )

***** URANIUM *****

RPP( 1101 1.31 6.31 <DI-0.025> <DI+0.025> 1 <HT-1> )

RPP( 1102 1.31 6.31 <DO+DI-0.025> <DO+DI+0.025> 1 <HT-1> )

RPP( 1103 1.31 6.31 <2*DO+DI-0.025> <2*DO+DI+0.025> 1 <HT-1> )

RPP( 1104 1.31 6.31 <3*DO+DI-0.025> <3*DO+DI+0.025> 1 <HT-1> )

RPP( 1105 1.31 6.31 <4*DO+DI-0.025> <4*DO+DI+0.025> 1 <HT-1> )

RPP( 1106 1.31 6.31 <5*DO+DI-0.025> <5*DO+DI+0.025> 1 <HT-1> )

RPP( 1107 1.31 6.31 <6*DO+DI-0.025> <6*DO+DI+0.025> 1 <HT-1> )

RPP( 1108 1.31 6.31 <7*DO+DI-0.025> <7*DO+DI+0.025> 1 <HT-1> )

RPP( 1109 1.31 6.31 <8*DO+DI-0.025> <8*DO+DI+0.025> 1 <HT-1> )

RPP( 1110 1.31 6.31 <9*DO+DI-0.025> <9*DO+DI+0.025> 1 <HT-1> )

RPP( 1111 1.31 6.31 <10*DO+DI-0.025> <10*DO+DI+0.025> 1 <HT-1> )

RPP( 1112 1.31 6.31 <11*DO+DI-0.025> <11*DO+DI+0.025> 1 <HT-1> )

RPP( 1113 1.31 6.31 <12*DO+DI-0.025> <12*DO+DI+0.025> 1 <HT-1> )

RPP( 1114 1.31 6.31 <13*DO+DI-0.025> <13*DO+DI+0.025> 1 <HT-1> )

RPP( 1115 1.31 6.31 <14*DO+DI-0.025> <14*DO+DI+0.025> 1 <HT-1> )

RPP( 1116 1.31 6.31 <15*DO+DI-0.025> <15*DO+DI+0.025> 1 <HT-1> )

RPP( 1117 1.31 6.31 <16*DO+DI-0.025> <16*DO+DI+0.025> 1 <HT-1> )

RPP( 1118 1.31 6.31 <17*DO+DI-0.025> <17*DO+DI+0.025> 1 <HT-1> )

RPP( 1119 1.31 6.31 <18*DO+DI-0.025> <18*DO+DI+0.025> 1 <HT-1> )

RPP( 1120 1.31 6.31 <19*DO+DI-0.025> <19*DO+DI+0.025> 1 <HT-1> )

RPP( 1121 1.31 6.31 <20*DO+DI-0.025> <20*DO+DI+0.025> 1 <HT-1> )
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***** CADMIUM *****

CYL(1201 0.267 <DI> 0.0 <HT> 0.02)
CYL(1202 0.267 <DO+DI> 0.0 <HT> 0.02)
CYL(1203 0.267 <2*DO+DI> 0.0 <HT> 0.02)
CYL(1204 0.267 <3*DO+DI> 0.0 <HT> 0.02)
CYL(1205 0.267 <4*DO+DI> 0.0 <HT> 0.02)
CYL(1206 0.267 <5*DO+DI> 0.0 <HT> 0.02)
CYL(1207 0.267 <6*DO+DI> 0.0 <HT> 0.02)
CYL(1208 0.267 <7*DO+DI> 0.0 <HT> 0.02)
CYL(1209 0.267 <8*DO+DI> 0.0 <HT> 0.02)
CYL(1210 0.267 <9*DO+DI> 0.0 <HT> 0.02)
CYL(1211 0.267 <10*DO+DI> 0.0 <HT> 0.02)
CYL(1212 0.267 <11*DO+DI> 0.0 <HT> 0.02)
CYL(1213 0.267 <12*DO+DI> 0.0 <HT> 0.02)
CYL(1214 0.267 <13*DO+DI> 0.0 <HT> 0.02)
CYL(1215 0.267 <14*DO+DI> 0.0 <HT> 0.02)
CYL(1216 0.267 <15*DO+DI> 0.0 <HT> 0.02)
CYL(1217 0.267 <16*DO+DI> 0.0 <HT> 0.02)
CYL(1218 0.267 <17*DO+DI> 0.0 <HT> 0.02)
CYL(1219 0.267 <18*DO+DI> 0.0 <HT> 0.02)
CYL(1220 0.267 <19*DO+DI> 0.0 <HT> 0.02)
CYL(1221 0.267 <20*DO+DI> 0.0 <HT> 0.02)
CYL(1301 7.403 <DI> 0.0 <HT> 0.02)
CYL(1302 7.403 <DO+DI> 0.0 <HT> 0.02)
CYL(1303 7.403 <2*DO+DI> 0.0 <HT> 0.02)
CYL(1304 7.403 <3*DO+DI> 0.0 <HT> 0.02)
CYL(1305 7.403 <4*DO+DI> 0.0 <HT> 0.02)
CYL(1306 7.403 <5*DO+DI> 0.0 <HT> 0.02)
CYL(1307 7.403 <6*DO+DI> 0.0 <HT> 0.02)
CYL(1308 7.403 <7*DO+DI> 0.0 <HT> 0.02)
CYL(1309 7.403 <8*DO+DI> 0.0 <HT> 0.02)
CYL(1310 7.403 <9*DO+DI> 0.0 <HT> 0.02)
CYL(1311 7.403 <10*DO+DI> 0.0 <HT> 0.02)
CYL(1312 7.403 <11*DO+DI> 0.0 <HT> 0.02)
CYL(1313 7.403 <12*DO+DI> 0.0 <HT> 0.02)
CYL(1314 7.403 <13*DO+DI> 0.0 <HT> 0.02)
CYL(1315 7.403 <14*DO+DI> 0.0 <HT> 0.02)
CYL(1316 7.403 <15*DO+DI> 0.0 <HT> 0.02)
CYL(1317 7.403 <16*DO+DI> 0.0 <HT> 0.02)
CYL(1318 7.403 <17*DO+DI> 0.0 <HT> 0.02)
CYL(1319 7.403 <18*DO+DI> 0.0 <HT> 0.02)
CYL(1320 7.403 <19*DO+DI> 0.0 <HT> 0.02)
CYL(1321 7.403 <20*DO+DI> 0.0 <HT> 0.02)

END

***** ZONE DATE *****

*

OUTS: : -2000: -30

REFL:REFL: <MD2O>: -10 -60 -50 -40 -510 -520 -530 -540 30

CNS:CNS: <MD2O>: 50

HORE:HORE: <MD2O>: 40

CR01:CR01:<HAFNI>: -521 520

WAT1:WAT1: <MH2O>: 521

CR02:CR02:<HAFNI>: -541 540

WAT2:WAT2: <MH2O>: 541

CR03:CR03:<HAFNI>: -511 510

WAT3:WAT3: <MH2O>: 511

CR04:CR04:<HAFNI>: -531 530

WAT4:WAT4: <MH2O>: 531

WAT5:WAT5: <MH2O>: 60

FILM:FILM:<MCLAD>: -20 10

CORE:CORE: -100: 20

#SUBFRAME

NAMES(HOLE FUE1 FUE2 FUE3 FUE4

FUE5 FUE6 FUE7 FUE8 FUE9

FU10 FU11 FU12 FU13 FU14

FU15 FU16 FU17 FU18 FU19 FU20)

SPACE(1 2 3 4 1

5 6 7 8 9

10 11 1 12 13

14 15 16 17 18

1 19 20 21 1)

#END SUBFRAME

#CELL ID(1) TYPE(BOX) /* HOLE

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HOL1:HOL1:<MCLAD>: 200

#END CELL

#CELL ID(2) TYPE(BOX) /* FUE1

YYYY:YYYY: -999: -300

FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005

-1006 -1007 -1008 -1009 -1010

-1011 -1012 -1013 -1014 -1015

-1016 -1017 -1018 -1019 -1020

-1021 -1022 -1101 -1102 -1103

-1104 -1105 -1106 -1107 -1108

-1109 -1110 -1111 -1112 -1113

-1114 -1115 -1116 -1117 -1118

-1119 -1120 -1121 -1201 -1202

-1203 -1204 -1205 -1206 -1207

-1208 -1209 -1210 -1211 -1212

-1213 -1214 -1215 -1216 -1217

-1218 -1219 -1220 -1221 -1301

-1302 -1303 -1304 -1305 -1306

-1307 -1308 -1309 -1310 -1311

-1312 -1313 -1314 -1315 -1316

-1317 -1318 -1319 -1320 -1321

MH2O:MH2O: <MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR

1006 OR 1007 OR 1008 OR 1009 OR 1010 OR

1011 OR 1012 OR 1013 OR 1014 OR 1015 OR

1016 OR 1017 OR 1018 OR 1019 OR 1020 OR
1021 OR 1022
FUPL:FUPL:<FUEL1>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR
1106 OR 1107 OR 1108 OR 1109 OR 1110 OR
1111 OR 1112 OR 1113 OR 1114 OR 1115 OR
1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121
CDWI:CDWI:<MCAD1>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR
1206 OR 1207 OR 1208 OR 1209 OR 1210 OR
1211 OR 1212 OR 1213 OR 1214 OR 1215 OR
1216 OR 1217 OR 1218 OR 1219 OR 1220 OR
1221 OR 1301 OR 1302 OR 1303 OR 1304 OR
1305 OR 1306 OR 1307 OR 1308 OR 1309 OR
1310 OR 1311 OR 1312 OR 1313 OR 1314 OR
1315 OR 1316 OR 1317 OR 1318 OR 1319 OR
1320 OR 1321

#END CELL

#CELL ID(3) TYPE(BOX) /* FUE2

YYYY:YYYY: -999:-300
FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005
-1006 -1007 -1008 -1009 -1010
-1011 -1012 -1013 -1014 -1015
-1016 -1017 -1018 -1019 -1020
-1021 -1022 -1101 -1102 -1103
-1104 -1105 -1106 -1107 -1108
-1109 -1110 -1111 -1112 -1113
-1114 -1115 -1116 -1117 -1118
-1119 -1120 -1121 -1201 -1202
-1203 -1204 -1205 -1206 -1207
-1208 -1209 -1210 -1211 -1212
-1213 -1214 -1215 -1216 -1217
-1218 -1219 -1220 -1221 -1301
-1302 -1303 -1304 -1305 -1306
-1307 -1308 -1309 -1310 -1311
-1312 -1313 -1314 -1315 -1316
-1317 -1318 -1319 -1320 -1321

MH2O:MH2O: <MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR
1006 OR 1007 OR 1008 OR 1009 OR 1010 OR
1011 OR 1012 OR 1013 OR 1014 OR 1015 OR
1016 OR 1017 OR 1018 OR 1019 OR 1020 OR
1021 OR 1022

FUPL:FUPL:<FUEL2>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR
1106 OR 1107 OR 1108 OR 1109 OR 1110 OR
1111 OR 1112 OR 1113 OR 1114 OR 1115 OR
1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121

CDWI:CDWI:<MCAD2>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR
1206 OR 1207 OR 1208 OR 1209 OR 1210 OR
1211 OR 1212 OR 1213 OR 1214 OR 1215 OR
1216 OR 1217 OR 1218 OR 1219 OR 1220 OR
1221 OR 1301 OR 1302 OR 1303 OR 1304 OR
1305 OR 1306 OR 1307 OR 1308 OR 1309 OR

1310 OR 1311 OR 1312 OR 1313 OR 1314 OR
1315 OR 1316 OR 1317 OR 1318 OR 1319 OR
1320 OR 1321

#END CELL

#CELL ID(4) TYPE(BOX) /* FUE3

YYYY:YYYY: -999:-300
FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005
-1006 -1007 -1008 -1009 -1010
-1011 -1012 -1013 -1014 -1015
-1016 -1017 -1018 -1019 -1020
-1021 -1022 -1101 -1102 -1103
-1104 -1105 -1106 -1107 -1108
-1109 -1110 -1111 -1112 -1113
-1114 -1115 -1116 -1117 -1118
-1119 -1120 -1121 -1201 -1202
-1203 -1204 -1205 -1206 -1207
-1208 -1209 -1210 -1211 -1212
-1213 -1214 -1215 -1216 -1217
-1218 -1219 -1220 -1221 -1301
-1302 -1303 -1304 -1305 -1306
-1307 -1308 -1309 -1310 -1311
-1312 -1313 -1314 -1315 -1316
-1317 -1318 -1319 -1320 -1321

MH2O:MH2O: <MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR
1006 OR 1007 OR 1008 OR 1009 OR 1010 OR
1011 OR 1012 OR 1013 OR 1014 OR 1015 OR
1016 OR 1017 OR 1018 OR 1019 OR 1020 OR
1021 OR 1022

FUPL:FUPL:<FUEL3>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR
1106 OR 1107 OR 1108 OR 1109 OR 1110 OR
1111 OR 1112 OR 1113 OR 1114 OR 1115 OR
1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121

CDWI:CDWI:<MCAD3>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR
1206 OR 1207 OR 1208 OR 1209 OR 1210 OR
1211 OR 1212 OR 1213 OR 1214 OR 1215 OR
1216 OR 1217 OR 1218 OR 1219 OR 1220 OR
1221 OR 1301 OR 1302 OR 1303 OR 1304 OR
1305 OR 1306 OR 1307 OR 1308 OR 1309 OR
1310 OR 1311 OR 1312 OR 1313 OR 1314 OR
1315 OR 1316 OR 1317 OR 1318 OR 1319 OR
1320 OR 1321

#END CELL

#CELL ID(5) TYPE(BOX) /* FUE4

YYYY:YYYY: -999:-300
FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005
-1006 -1007 -1008 -1009 -1010
-1011 -1012 -1013 -1014 -1015
-1016 -1017 -1018 -1019 -1020
-1021 -1022 -1101 -1102 -1103

-1104 -1105 -1106 -1107 -1108
-1109 -1110 -1111 -1112 -1113
-1114 -1115 -1116 -1117 -1118
-1119 -1120 -1121 -1201 -1202
-1203 -1204 -1205 -1206 -1207
-1208 -1209 -1210 -1211 -1212
-1213 -1214 -1215 -1216 -1217
-1218 -1219 -1220 -1221 -1301
-1302 -1303 -1304 -1305 -1306
-1307 -1308 -1309 -1310 -1311
-1312 -1313 -1314 -1315 -1316
-1317 -1318 -1319 -1320 -1321

MH2O:MH2O: <MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR
1006 OR 1007 OR 1008 OR 1009 OR 1010 OR
1011 OR 1012 OR 1013 OR 1014 OR 1015 OR
1016 OR 1017 OR 1018 OR 1019 OR 1020 OR
1021 OR 1022

FUPL:FUPL:<FUEL4>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR
1106 OR 1107 OR 1108 OR 1109 OR 1110 OR
1111 OR 1112 OR 1113 OR 1114 OR 1115 OR
1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121

CDWI:CDWI:<MCAD4>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR
1206 OR 1207 OR 1208 OR 1209 OR 1210 OR
1211 OR 1212 OR 1213 OR 1214 OR 1215 OR
1216 OR 1217 OR 1218 OR 1219 OR 1220 OR
1221 OR 1301 OR 1302 OR 1303 OR 1304 OR
1305 OR 1306 OR 1307 OR 1308 OR 1309 OR
1310 OR 1311 OR 1312 OR 1313 OR 1314 OR
1315 OR 1316 OR 1317 OR 1318 OR 1319 OR
1320 OR 1321

#END CELL

#CELL ID(6) TYPE(BOX) /* FUE5

YYYY:YYYY: -999: -300

FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005
-1006 -1007 -1008 -1009 -1010
-1011 -1012 -1013 -1014 -1015
-1016 -1017 -1018 -1019 -1020
-1021 -1022 -1101 -1102 -1103
-1104 -1105 -1106 -1107 -1108
-1109 -1110 -1111 -1112 -1113
-1114 -1115 -1116 -1117 -1118
-1119 -1120 -1121 -1201 -1202
-1203 -1204 -1205 -1206 -1207
-1208 -1209 -1210 -1211 -1212
-1213 -1214 -1215 -1216 -1217
-1218 -1219 -1220 -1221 -1301
-1302 -1303 -1304 -1305 -1306
-1307 -1308 -1309 -1310 -1311
-1312 -1313 -1314 -1315 -1316
-1317 -1318 -1319 -1320 -1321

MH2O:MH2O: <MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR
1006 OR 1007 OR 1008 OR 1009 OR 1010 OR
1011 OR 1012 OR 1013 OR 1014 OR 1015 OR
1016 OR 1017 OR 1018 OR 1019 OR 1020 OR
1021 OR 1022

FUPL:FUPL:<FUEL5>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR
1106 OR 1107 OR 1108 OR 1109 OR 1110 OR
1111 OR 1112 OR 1113 OR 1114 OR 1115 OR
1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121

CDWI:CDWI:<MCAD5>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR
1206 OR 1207 OR 1208 OR 1209 OR 1210 OR
1211 OR 1212 OR 1213 OR 1214 OR 1215 OR
1216 OR 1217 OR 1218 OR 1219 OR 1220 OR
1221 OR 1301 OR 1302 OR 1303 OR 1304 OR
1305 OR 1306 OR 1307 OR 1308 OR 1309 OR
1310 OR 1311 OR 1312 OR 1313 OR 1314 OR
1315 OR 1316 OR 1317 OR 1318 OR 1319 OR
1320 OR 1321

#END CELL

#CELL ID(7) TYPE(BOX) /* FUE6

YYYY:YYYY: -999: -300

FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005
-1006 -1007 -1008 -1009 -1010
-1011 -1012 -1013 -1014 -1015
-1016 -1017 -1018 -1019 -1020
-1021 -1022 -1101 -1102 -1103
-1104 -1105 -1106 -1107 -1108
-1109 -1110 -1111 -1112 -1113
-1114 -1115 -1116 -1117 -1118
-1119 -1120 -1121 -1201 -1202
-1203 -1204 -1205 -1206 -1207
-1208 -1209 -1210 -1211 -1212
-1213 -1214 -1215 -1216 -1217
-1218 -1219 -1220 -1221 -1301
-1302 -1303 -1304 -1305 -1306
-1307 -1308 -1309 -1310 -1311
-1312 -1313 -1314 -1315 -1316
-1317 -1318 -1319 -1320 -1321

MH2O:MH2O: <MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR
1006 OR 1007 OR 1008 OR 1009 OR 1010 OR
1011 OR 1012 OR 1013 OR 1014 OR 1015 OR
1016 OR 1017 OR 1018 OR 1019 OR 1020 OR
1021 OR 1022

FUPL:FUPL:<FUEL6>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR
1106 OR 1107 OR 1108 OR 1109 OR 1110 OR
1111 OR 1112 OR 1113 OR 1114 OR 1115 OR
1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121

CDWI:CDWI:<MCAD6>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR
1206 OR 1207 OR 1208 OR 1209 OR 1210 OR
1211 OR 1212 OR 1213 OR 1214 OR 1215 OR

1216 OR 1217 OR 1218 OR 1219 OR 1220 OR
1221 OR 1301 OR 1302 OR 1303 OR 1304 OR
1305 OR 1306 OR 1307 OR 1308 OR 1309 OR
1310 OR 1311 OR 1312 OR 1313 OR 1314 OR
1315 OR 1316 OR 1317 OR 1318 OR 1319 OR
1320 OR 1321

#END CELL

#CELL ID(8) TYPE(BOX) /* FUE7

YYYY:YYYY: -999: -300

FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005

-1006 -1007 -1008 -1009 -1010

-1011 -1012 -1013 -1014 -1015

-1016 -1017 -1018 -1019 -1020

-1021 -1022 -1101 -1102 -1103

-1104 -1105 -1106 -1107 -1108

-1109 -1110 -1111 -1112 -1113

-1114 -1115 -1116 -1117 -1118

-1119 -1120 -1121 -1201 -1202

-1203 -1204 -1205 -1206 -1207

-1208 -1209 -1210 -1211 -1212

-1213 -1214 -1215 -1216 -1217

-1218 -1219 -1220 -1221 -1301

-1302 -1303 -1304 -1305 -1306

-1307 -1308 -1309 -1310 -1311

-1312 -1313 -1314 -1315 -1316

-1317 -1318 -1319 -1320 -1321

MH2O:MH2O: <MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR

1006 OR 1007 OR 1008 OR 1009 OR 1010 OR

1011 OR 1012 OR 1013 OR 1014 OR 1015 OR

1016 OR 1017 OR 1018 OR 1019 OR 1020 OR

1021 OR 1022

FUPL:FUPL:<FUEL7>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR

1106 OR 1107 OR 1108 OR 1109 OR 1110 OR

1111 OR 1112 OR 1113 OR 1114 OR 1115 OR

1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121

CDWI:CDWI:<MCAD7>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR

1206 OR 1207 OR 1208 OR 1209 OR 1210 OR

1211 OR 1212 OR 1213 OR 1214 OR 1215 OR

1216 OR 1217 OR 1218 OR 1219 OR 1220 OR

1221 OR 1301 OR 1302 OR 1303 OR 1304 OR

1305 OR 1306 OR 1307 OR 1308 OR 1309 OR

1310 OR 1311 OR 1312 OR 1313 OR 1314 OR

1315 OR 1316 OR 1317 OR 1318 OR 1319 OR

1320 OR 1321

#END CELL

#CELL ID(9) TYPE(BOX) /* FUE8

YYYY:YYYY: -999: -300

FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005

-1006 -1007 -1008 -1009 -1010

-1011 -1012 -1013 -1014 -1015

-1016 -1017 -1018 -1019 -1020

-1021 -1022 -1101 -1102 -1103

-1104 -1105 -1106 -1107 -1108

-1109 -1110 -1111 -1112 -1113

-1114 -1115 -1116 -1117 -1118

-1119 -1120 -1121 -1201 -1202

-1203 -1204 -1205 -1206 -1207

-1208 -1209 -1210 -1211 -1212

-1213 -1214 -1215 -1216 -1217

-1218 -1219 -1220 -1221 -1301

-1302 -1303 -1304 -1305 -1306

-1307 -1308 -1309 -1310 -1311

-1312 -1313 -1314 -1315 -1316

-1317 -1318 -1319 -1320 -1321

MH2O:MH2O: <MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR

1006 OR 1007 OR 1008 OR 1009 OR 1010 OR

1011 OR 1012 OR 1013 OR 1014 OR 1015 OR

1016 OR 1017 OR 1018 OR 1019 OR 1020 OR

1021 OR 1022

FUPL:FUPL:<FUEL8>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR

1106 OR 1107 OR 1108 OR 1109 OR 1110 OR

1111 OR 1112 OR 1113 OR 1114 OR 1115 OR

1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121

CDWI:CDWI:<MCAD8>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR

1206 OR 1207 OR 1208 OR 1209 OR 1210 OR

1211 OR 1212 OR 1213 OR 1214 OR 1215 OR

1216 OR 1217 OR 1218 OR 1219 OR 1220 OR

1221 OR 1301 OR 1302 OR 1303 OR 1304 OR

1305 OR 1306 OR 1307 OR 1308 OR 1309 OR

1310 OR 1311 OR 1312 OR 1313 OR 1314 OR

1315 OR 1316 OR 1317 OR 1318 OR 1319 OR

1320 OR 1321

#END CELL

#CELL ID(10) TYPE(BOX) /* FUE9

YYYY:YYYY: -999: -300

FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005

-1006 -1007 -1008 -1009 -1010

-1011 -1012 -1013 -1014 -1015

-1016 -1017 -1018 -1019 -1020

-1021 -1022 -1101 -1102 -1103

-1104 -1105 -1106 -1107 -1108

-1109 -1110 -1111 -1112 -1113

-1114 -1115 -1116 -1117 -1118

-1119 -1120 -1121 -1201 -1202

-1203 -1204 -1205 -1206 -1207

-1208 -1209 -1210 -1211 -1212

-1213 -1214 -1215 -1216 -1217

-1218 -1219 -1220 -1221 -1301

-1302 -1303 -1304 -1305 -1306

-1307 -1308 -1309 -1310 -1311
-1312 -1313 -1314 -1315 -1316
-1317 -1318 -1319 -1320 -1321
MH2O:MH2O: <MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR
1006 OR 1007 OR 1008 OR 1009 OR 1010 OR
1011 OR 1012 OR 1013 OR 1014 OR 1015 OR
1016 OR 1017 OR 1018 OR 1019 OR 1020 OR
1021 OR 1022
FUPL:FUPL:<FUEL9>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR
1106 OR 1107 OR 1108 OR 1109 OR 1110 OR
1111 OR 1112 OR 1113 OR 1114 OR 1115 OR
1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121
CDWI:CDWI:<MCAD9>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR
1206 OR 1207 OR 1208 OR 1209 OR 1210 OR
1211 OR 1212 OR 1213 OR 1214 OR 1215 OR
1216 OR 1217 OR 1218 OR 1219 OR 1220 OR
1221 OR 1301 OR 1302 OR 1303 OR 1304 OR
1305 OR 1306 OR 1307 OR 1308 OR 1309 OR
1310 OR 1311 OR 1312 OR 1313 OR 1314 OR
1315 OR 1316 OR 1317 OR 1318 OR 1319 OR
1320 OR 1321
#END CELL

#CELL ID(11) TYPE(BOX) /* FU10
YYYY:YYYY: -999: -300
FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005
-1006 -1007 -1008 -1009 -1010
-1011 -1012 -1013 -1014 -1015
-1016 -1017 -1018 -1019 -1020
-1021 -1022 -1101 -1102 -1103
-1104 -1105 -1106 -1107 -1108
-1109 -1110 -1111 -1112 -1113
-1114 -1115 -1116 -1117 -1118
-1119 -1120 -1121 -1201 -1202
-1203 -1204 -1205 -1206 -1207
-1208 -1209 -1210 -1211 -1212
-1213 -1214 -1215 -1216 -1217
-1218 -1219 -1220 -1221 -1301
-1302 -1303 -1304 -1305 -1306
-1307 -1308 -1309 -1310 -1311
-1312 -1313 -1314 -1315 -1316
-1317 -1318 -1319 -1320 -1321
MH2O:MH2O: <MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR
1006 OR 1007 OR 1008 OR 1009 OR 1010 OR
1011 OR 1012 OR 1013 OR 1014 OR 1015 OR
1016 OR 1017 OR 1018 OR 1019 OR 1020 OR
1021 OR 1022
FUPL:FUPL:<FUE10>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR
1106 OR 1107 OR 1108 OR 1109 OR 1110 OR
1111 OR 1112 OR 1113 OR 1114 OR 1115 OR
1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121

CDWI:CDWI:<MCA10>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR
1206 OR 1207 OR 1208 OR 1209 OR 1210 OR
1211 OR 1212 OR 1213 OR 1214 OR 1215 OR
1216 OR 1217 OR 1218 OR 1219 OR 1220 OR
1221 OR 1301 OR 1302 OR 1303 OR 1304 OR
1305 OR 1306 OR 1307 OR 1308 OR 1309 OR
1310 OR 1311 OR 1312 OR 1313 OR 1314 OR
1315 OR 1316 OR 1317 OR 1318 OR 1319 OR
1320 OR 1321
#END CELL

#CELL ID(12) TYPE(BOX) /* FU11
YYYY:YYYY: -999: -300
FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005
-1006 -1007 -1008 -1009 -1010
-1011 -1012 -1013 -1014 -1015
-1016 -1017 -1018 -1019 -1020
-1021 -1022 -1101 -1102 -1103
-1104 -1105 -1106 -1107 -1108
-1109 -1110 -1111 -1112 -1113
-1114 -1115 -1116 -1117 -1118
-1119 -1120 -1121 -1201 -1202
-1203 -1204 -1205 -1206 -1207
-1208 -1209 -1210 -1211 -1212
-1213 -1214 -1215 -1216 -1217
-1218 -1219 -1220 -1221 -1301
-1302 -1303 -1304 -1305 -1306
-1307 -1308 -1309 -1310 -1311
-1312 -1313 -1314 -1315 -1316
-1317 -1318 -1319 -1320 -1321
MH2O:MH2O: <MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR
1006 OR 1007 OR 1008 OR 1009 OR 1010 OR
1011 OR 1012 OR 1013 OR 1014 OR 1015 OR
1016 OR 1017 OR 1018 OR 1019 OR 1020 OR
1021 OR 1022
FUPL:FUPL:<FUE11>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR
1106 OR 1107 OR 1108 OR 1109 OR 1110 OR
1111 OR 1112 OR 1113 OR 1114 OR 1115 OR
1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121
CDWI:CDWI:<MCA11>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR
1206 OR 1207 OR 1208 OR 1209 OR 1210 OR
1211 OR 1212 OR 1213 OR 1214 OR 1215 OR
1216 OR 1217 OR 1218 OR 1219 OR 1220 OR
1221 OR 1301 OR 1302 OR 1303 OR 1304 OR
1305 OR 1306 OR 1307 OR 1308 OR 1309 OR
1310 OR 1311 OR 1312 OR 1313 OR 1314 OR
1315 OR 1316 OR 1317 OR 1318 OR 1319 OR
1320 OR 1321
#END CELL

#CELL ID(13) TYPE(BOX) /* FUE12

YYYY:YYYY: -999: -300	-1213 -1214 -1215 -1216 -1217
FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005	-1218 -1219 -1220 -1221 -1301
-1006 -1007 -1008 -1009 -1010	-1302 -1303 -1304 -1305 -1306
-1011 -1012 -1013 -1014 -1015	-1307 -1308 -1309 -1310 -1311
-1016 -1017 -1018 -1019 -1020	-1312 -1313 -1314 -1315 -1316
-1021 -1022 -1101 -1102 -1103	-1317 -1318 -1319 -1320 -1321
-1104 -1105 -1106 -1107 -1108	MH2O:MH2O: <MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR
-1109 -1110 -1111 -1112 -1113	1006 OR 1007 OR 1008 OR 1009 OR 1010 OR
-1114 -1115 -1116 -1117 -1118	1011 OR 1012 OR 1013 OR 1014 OR 1015 OR
-1119 -1120 -1121 -1201 -1202	1016 OR 1017 OR 1018 OR 1019 OR 1020 OR
-1203 -1204 -1205 -1206 -1207	1021 OR 1022
-1208 -1209 -1210 -1211 -1212	FUPL:FUPL:<FUE13>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR
-1213 -1214 -1215 -1216 -1217	1106 OR 1107 OR 1108 OR 1109 OR 1110 OR
-1218 -1219 -1220 -1221 -1301	1111 OR 1112 OR 1113 OR 1114 OR 1115 OR
-1302 -1303 -1304 -1305 -1306	1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121
-1307 -1308 -1309 -1310 -1311	CDWI:CDWI:<MCA13>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR
-1312 -1313 -1314 -1315 -1316	1206 OR 1207 OR 1208 OR 1209 OR 1210 OR
-1317 -1318 -1319 -1320 -1321	1211 OR 1212 OR 1213 OR 1214 OR 1215 OR
MH2O:MH2O: <MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR	1216 OR 1217 OR 1218 OR 1219 OR 1220 OR
1006 OR 1007 OR 1008 OR 1009 OR 1010 OR	1221 OR 1301 OR 1302 OR 1303 OR 1304 OR
1011 OR 1012 OR 1013 OR 1014 OR 1015 OR	1305 OR 1306 OR 1307 OR 1308 OR 1309 OR
1016 OR 1017 OR 1018 OR 1019 OR 1020 OR	1310 OR 1311 OR 1312 OR 1313 OR 1314 OR
1021 OR 1022	1315 OR 1316 OR 1317 OR 1318 OR 1319 OR
FUPL:FUPL:<FUE12>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR	1320 OR 1321
1106 OR 1107 OR 1108 OR 1109 OR 1110 OR	#END CELL
1111 OR 1112 OR 1113 OR 1114 OR 1115 OR	
1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121	#CELL ID(15) TYPE(BOX) /* FU14
CDWI:CDWI:<MCA12>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR	YYYY:YYYY: -999: -300
1206 OR 1207 OR 1208 OR 1209 OR 1210 OR	FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005
1211 OR 1212 OR 1213 OR 1214 OR 1215 OR	-1006 -1007 -1008 -1009 -1010
1216 OR 1217 OR 1218 OR 1219 OR 1220 OR	-1011 -1012 -1013 -1014 -1015
1221 OR 1301 OR 1302 OR 1303 OR 1304 OR	-1016 -1017 -1018 -1019 -1020
1305 OR 1306 OR 1307 OR 1308 OR 1309 OR	-1021 -1022 -1101 -1102 -1103
1310 OR 1311 OR 1312 OR 1313 OR 1314 OR	-1104 -1105 -1106 -1107 -1108
1315 OR 1316 OR 1317 OR 1318 OR 1319 OR	-1109 -1110 -1111 -1112 -1113
1320 OR 1321	-1114 -1115 -1116 -1117 -1118
#END CELL	-1119 -1120 -1121 -1201 -1202
	-1203 -1204 -1205 -1206 -1207
#CELL ID(14) TYPE(BOX) /* FU13	-1208 -1209 -1210 -1211 -1212
YYYY:YYYY: -999: -300	-1213 -1214 -1215 -1216 -1217
FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005	-1218 -1219 -1220 -1221 -1301
-1006 -1007 -1008 -1009 -1010	-1302 -1303 -1304 -1305 -1306
-1011 -1012 -1013 -1014 -1015	-1307 -1308 -1309 -1310 -1311
-1016 -1017 -1018 -1019 -1020	-1312 -1313 -1314 -1315 -1316
-1021 -1022 -1101 -1102 -1103	-1317 -1318 -1319 -1320 -1321
-1104 -1105 -1106 -1107 -1108	MH2O:MH2O: <MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR
-1109 -1110 -1111 -1112 -1113	1006 OR 1007 OR 1008 OR 1009 OR 1010 OR
-1114 -1115 -1116 -1117 -1118	1011 OR 1012 OR 1013 OR 1014 OR 1015 OR
-1119 -1120 -1121 -1201 -1202	1016 OR 1017 OR 1018 OR 1019 OR 1020 OR
-1203 -1204 -1205 -1206 -1207	1021 OR 1022
-1208 -1209 -1210 -1211 -1212	FUPL:FUPL:<FUE14>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR

1106 OR 1107 OR 1108 OR 1109 OR 1110 OR
1111 OR 1112 OR 1113 OR 1114 OR 1115 OR
1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121
CDWI:CDWI:<MCA14>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR
1206 OR 1207 OR 1208 OR 1209 OR 1210 OR
1211 OR 1212 OR 1213 OR 1214 OR 1215 OR
1216 OR 1217 OR 1218 OR 1219 OR 1220 OR
1221 OR 1301 OR 1302 OR 1303 OR 1304 OR
1305 OR 1306 OR 1307 OR 1308 OR 1309 OR
1310 OR 1311 OR 1312 OR 1313 OR 1314 OR
1315 OR 1316 OR 1317 OR 1318 OR 1319 OR
1320 OR 1321

#END CELL

#CELL ID(16) TYPE(BOX) /* FU15

YYYY:YYYY: -999: -300
FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005
-1006 -1007 -1008 -1009 -1010
-1011 -1012 -1013 -1014 -1015
-1016 -1017 -1018 -1019 -1020
-1021 -1022 -1101 -1102 -1103
-1104 -1105 -1106 -1107 -1108
-1109 -1110 -1111 -1112 -1113
-1114 -1115 -1116 -1117 -1118
-1119 -1120 -1121 -1201 -1202
-1203 -1204 -1205 -1206 -1207
-1208 -1209 -1210 -1211 -1212
-1213 -1214 -1215 -1216 -1217
-1218 -1219 -1220 -1221 -1301
-1302 -1303 -1304 -1305 -1306
-1307 -1308 -1309 -1310 -1311
-1312 -1313 -1314 -1315 -1316
-1317 -1318 -1319 -1320 -1321

MH2O:MH2O: <MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR
1006 OR 1007 OR 1008 OR 1009 OR 1010 OR
1011 OR 1012 OR 1013 OR 1014 OR 1015 OR
1016 OR 1017 OR 1018 OR 1019 OR 1020 OR
1021 OR 1022

FUPL:FUPL:<FUE15>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR
1106 OR 1107 OR 1108 OR 1109 OR 1110 OR
1111 OR 1112 OR 1113 OR 1114 OR 1115 OR
1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121

CDWI:CDWI:<MCA15>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR
1206 OR 1207 OR 1208 OR 1209 OR 1210 OR
1211 OR 1212 OR 1213 OR 1214 OR 1215 OR
1216 OR 1217 OR 1218 OR 1219 OR 1220 OR
1221 OR 1301 OR 1302 OR 1303 OR 1304 OR
1305 OR 1306 OR 1307 OR 1308 OR 1309 OR
1310 OR 1311 OR 1312 OR 1313 OR 1314 OR
1315 OR 1316 OR 1317 OR 1318 OR 1319 OR
1320 OR 1321

#END CELL

#CELL ID(17) TYPE(BOX) /* FU16

YYYY:YYYY: -999: -300
FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005
-1006 -1007 -1008 -1009 -1010
-1011 -1012 -1013 -1014 -1015
-1016 -1017 -1018 -1019 -1020
-1021 -1022 -1101 -1102 -1103
-1104 -1105 -1106 -1107 -1108
-1109 -1110 -1111 -1112 -1113
-1114 -1115 -1116 -1117 -1118
-1119 -1120 -1121 -1201 -1202
-1203 -1204 -1205 -1206 -1207
-1208 -1209 -1210 -1211 -1212
-1213 -1214 -1215 -1216 -1217
-1218 -1219 -1220 -1221 -1301
-1302 -1303 -1304 -1305 -1306
-1307 -1308 -1309 -1310 -1311
-1312 -1313 -1314 -1315 -1316
-1317 -1318 -1319 -1320 -1321

MH2O:MH2O: <MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR
1006 OR 1007 OR 1008 OR 1009 OR 1010 OR
1011 OR 1012 OR 1013 OR 1014 OR 1015 OR
1016 OR 1017 OR 1018 OR 1019 OR 1020 OR
1021 OR 1022

FUPL:FUPL:<FUE16>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR
1106 OR 1107 OR 1108 OR 1109 OR 1110 OR
1111 OR 1112 OR 1113 OR 1114 OR 1115 OR
1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121

CDWI:CDWI:<MCA16>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR
1206 OR 1207 OR 1208 OR 1209 OR 1210 OR
1211 OR 1212 OR 1213 OR 1214 OR 1215 OR
1216 OR 1217 OR 1218 OR 1219 OR 1220 OR
1221 OR 1301 OR 1302 OR 1303 OR 1304 OR
1305 OR 1306 OR 1307 OR 1308 OR 1309 OR
1310 OR 1311 OR 1312 OR 1313 OR 1314 OR
1315 OR 1316 OR 1317 OR 1318 OR 1319 OR
1320 OR 1321

#END CELL

#CELL ID(18) TYPE(BOX) /* FU17

YYYY:YYYY: -999: -300
FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005
-1006 -1007 -1008 -1009 -1010
-1011 -1012 -1013 -1014 -1015
-1016 -1017 -1018 -1019 -1020
-1021 -1022 -1101 -1102 -1103
-1104 -1105 -1106 -1107 -1108
-1109 -1110 -1111 -1112 -1113
-1114 -1115 -1116 -1117 -1118

-1119 -1120 -1121 -1201 -1202
-1203 -1204 -1205 -1206 -1207
-1208 -1209 -1210 -1211 -1212
-1213 -1214 -1215 -1216 -1217
-1218 -1219 -1220 -1221 -1301
-1302 -1303 -1304 -1305 -1306
-1307 -1308 -1309 -1310 -1311
-1312 -1313 -1314 -1315 -1316
-1317 -1318 -1319 -1320 -1321
MH2O:MH2O:<MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR
1006 OR 1007 OR 1008 OR 1009 OR 1010 OR
1011 OR 1012 OR 1013 OR 1014 OR 1015 OR
1016 OR 1017 OR 1018 OR 1019 OR 1020 OR
1021 OR 1022
FUPL:FUPL:<FUE17>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR
1106 OR 1107 OR 1108 OR 1109 OR 1110 OR
1111 OR 1112 OR 1113 OR 1114 OR 1115 OR
1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121
CDWI:CDWI:<MCA17>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR
1206 OR 1207 OR 1208 OR 1209 OR 1210 OR
1211 OR 1212 OR 1213 OR 1214 OR 1215 OR
1216 OR 1217 OR 1218 OR 1219 OR 1220 OR
1221 OR 1301 OR 1302 OR 1303 OR 1304 OR
1305 OR 1306 OR 1307 OR 1308 OR 1309 OR
1310 OR 1311 OR 1312 OR 1313 OR 1314 OR
1315 OR 1316 OR 1317 OR 1318 OR 1319 OR
1320 OR 1321
#END CELL

#CELL ID(19) TYPE(BOX) /* FU18
YYYY:YYYY: -999: -300
FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005
-1006 -1007 -1008 -1009 -1010
-1011 -1012 -1013 -1014 -1015
-1016 -1017 -1018 -1019 -1020
-1021 -1022 -1101 -1102 -1103
-1104 -1105 -1106 -1107 -1108
-1109 -1110 -1111 -1112 -1113
-1114 -1115 -1116 -1117 -1118
-1119 -1120 -1121 -1201 -1202
-1203 -1204 -1205 -1206 -1207
-1208 -1209 -1210 -1211 -1212
-1213 -1214 -1215 -1216 -1217
-1218 -1219 -1220 -1221 -1301
-1302 -1303 -1304 -1305 -1306
-1307 -1308 -1309 -1310 -1311
-1312 -1313 -1314 -1315 -1316
-1317 -1318 -1319 -1320 -1321
MH2O:MH2O:<MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR
1006 OR 1007 OR 1008 OR 1009 OR 1010 OR
1011 OR 1012 OR 1013 OR 1014 OR 1015 OR
1016 OR 1017 OR 1018 OR 1019 OR 1020 OR
1021 OR 1022
FUPL:FUPL:<FUE19>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR
1106 OR 1107 OR 1108 OR 1109 OR 1110 OR
1111 OR 1112 OR 1113 OR 1114 OR 1115 OR
1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121
CDWI:CDWI:<MCA19>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR
1206 OR 1207 OR 1208 OR 1209 OR 1210 OR
1211 OR 1212 OR 1213 OR 1214 OR 1215 OR
1216 OR 1217 OR 1218 OR 1219 OR 1220 OR
1221 OR 1301 OR 1302 OR 1303 OR 1304 OR
1305 OR 1306 OR 1307 OR 1308 OR 1309 OR

1016 OR 1017 OR 1018 OR 1019 OR 1020 OR
1021 OR 1022
FUPL:FUPL:<FUE18>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR
1106 OR 1107 OR 1108 OR 1109 OR 1110 OR
1111 OR 1112 OR 1113 OR 1114 OR 1115 OR
1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121
CDWI:CDWI:<MCA18>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR
1206 OR 1207 OR 1208 OR 1209 OR 1210 OR
1211 OR 1212 OR 1213 OR 1214 OR 1215 OR
1216 OR 1217 OR 1218 OR 1219 OR 1220 OR
1221 OR 1301 OR 1302 OR 1303 OR 1304 OR
1305 OR 1306 OR 1307 OR 1308 OR 1309 OR
1310 OR 1311 OR 1312 OR 1313 OR 1314 OR
1315 OR 1316 OR 1317 OR 1318 OR 1319 OR
1320 OR 1321
#END CELL

#CELL ID(20) TYPE(BOX) /* FU19
YYYY:YYYY: -999: -300
FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005
-1006 -1007 -1008 -1009 -1010
-1011 -1012 -1013 -1014 -1015
-1016 -1017 -1018 -1019 -1020
-1021 -1022 -1101 -1102 -1103
-1104 -1105 -1106 -1107 -1108
-1109 -1110 -1111 -1112 -1113
-1114 -1115 -1116 -1117 -1118
-1119 -1120 -1121 -1201 -1202
-1203 -1204 -1205 -1206 -1207
-1208 -1209 -1210 -1211 -1212
-1213 -1214 -1215 -1216 -1217
-1218 -1219 -1220 -1221 -1301
-1302 -1303 -1304 -1305 -1306
-1307 -1308 -1309 -1310 -1311
-1312 -1313 -1314 -1315 -1316
-1317 -1318 -1319 -1320 -1321
MH2O:MH2O:<MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR
1006 OR 1007 OR 1008 OR 1009 OR 1010 OR
1011 OR 1012 OR 1013 OR 1014 OR 1015 OR
1016 OR 1017 OR 1018 OR 1019 OR 1020 OR
1021 OR 1022
FUPL:FUPL:<FUE19>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR
1106 OR 1107 OR 1108 OR 1109 OR 1110 OR
1111 OR 1112 OR 1113 OR 1114 OR 1115 OR
1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121
CDWI:CDWI:<MCA19>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR
1206 OR 1207 OR 1208 OR 1209 OR 1210 OR
1211 OR 1212 OR 1213 OR 1214 OR 1215 OR
1216 OR 1217 OR 1218 OR 1219 OR 1220 OR
1221 OR 1301 OR 1302 OR 1303 OR 1304 OR
1305 OR 1306 OR 1307 OR 1308 OR 1309 OR

1310 OR 1311 OR 1312 OR 1313 OR 1314 OR
1315 OR 1316 OR 1317 OR 1318 OR 1319 OR
1320 OR 1321
#END CELL

#CELL ID(21) TYPE(BOX) /* FU20

YYYY:YYYY: -999:-300
FUPL:FUPL:<MCLAD>: 300 -1001 -1002 -1003 -1004 -1005
-1006 -1007 -1008 -1009 -1010
-1011 -1012 -1013 -1014 -1015
-1016 -1017 -1018 -1019 -1020
-1021 -1022 -1101 -1102 -1103
-1104 -1105 -1106 -1107 -1108
-1109 -1110 -1111 -1112 -1113
-1114 -1115 -1116 -1117 -1118
-1119 -1120 -1121 -1201 -1202
-1203 -1204 -1205 -1206 -1207
-1208 -1209 -1210 -1211 -1212
-1213 -1214 -1215 -1216 -1217
-1218 -1219 -1220 -1221 -1301
-1302 -1303 -1304 -1305 -1306
-1307 -1308 -1309 -1310 -1311
-1312 -1313 -1314 -1315 -1316
-1317 -1318 -1319 -1320 -1321

MH2O:MH2O:<MH2O>: 1001 OR 1002 OR 1003 OR 1004 OR 1005 OR
1006 OR 1007 OR 1008 OR 1009 OR 1010 OR
1011 OR 1012 OR 1013 OR 1014 OR 1015 OR
1016 OR 1017 OR 1018 OR 1019 OR 1020 OR
1021 OR 1022

FUPL:FUPL:<FUE20>: 1101 OR 1102 OR 1103 OR 1104 OR 1105 OR
1106 OR 1107 OR 1108 OR 1109 OR 1110 OR
1111 OR 1112 OR 1113 OR 1114 OR 1115 OR
1116 OR 1117 OR 1118 OR 1119 OR 1120 OR 1121

CDWI:CDWI:<MCA20>: 1201 OR 1202 OR 1203 OR 1204 OR 1205 OR
1206 OR 1207 OR 1208 OR 1209 OR 1210 OR
1211 OR 1212 OR 1213 OR 1214 OR 1215 OR
1216 OR 1217 OR 1218 OR 1219 OR 1220 OR
1221 OR 1301 OR 1302 OR 1303 OR 1304 OR
1305 OR 1306 OR 1307 OR 1308 OR 1309 OR
1310 OR 1311 OR 1312 OR 1313 OR 1314 OR
1315 OR 1316 OR 1317 OR 1318 OR 1319 OR
1320 OR 1321

#END CELL

***** TALLY REGION DATA *****

\$END GEOM

***** INITIAL SOURCE *****

\$SOURCE

&

NEUTRON

RATIO(1.0)

@E = #FISSION(U02350* 0.0253) ;

@X = #UNIFORM(0.760 6.960) ;

@Y = #UNIFORM(0.1555 0.2065) ;

@Z = #UNIFORM(0.0 <HT>) ;

SEND SOURCE

***** VARIANCE REDUCTION PARAMETERS *****

% NR = %NREG, NRG=NR*NG

WKIL(<NRG>(0.2))

WSRV(<NRG>(1.0))

***** FISSION NEUTRON GENERATION *****

WGTF(<NR>(0.8))

***** TALLY ENERGY BOUNDARIES *****

ENGYB(2.00000E+7 5.00000E-1 1.00000E-5)

***** INPUT FOR CGVIEW *****

/

TITLE(New Research Reactor)

PAPER(-20 -20 50 1 0 0 1 0 -1)

XMAX(40 40)

LEVEL(2)

SPTYP(2)

/

TITLE(New Research Reactor XZ)

PAPER(-100 -100 50 1 0 0 1 0 -1)

XMAX(200 200)

LEVEL(2)

SPTYP(2)

/

TITLE(Fuel element)

PAPER(3.81 11.43 50 1 0 0 1 0 -1)

XMAX(7.62 7.62)

LEVEL(2)

SPTYP(2)

/